AN EXPERIMENTAL STUDY OF THE EMERGENCE OF INSIGHTFUL BEHAVIOR

by

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FIGURE 1.

I. INTRODUCTORY STATEMENT OF THE PROBLEM

The presentation of a series of visual patterns consisting of a pair of pairs of circular spots or areas of light intensity against a black background was chosen as the basis for this experiment. The problem was one of the relationship within the pair in relation to the relationship within the other pair. This provided a stimulus setting for a series of relative judgments.

It is at once apparent that, given two pairs of light of varying intensity, each member of the pair is less than, equal to, or greater than the other member, and between the pairs there is a relationship of Greater Difference, Lesser Difference, Greater Summation, Lesser Summation, or Equality.

Our problem was designed to determine the ability of a human subject to solve a given problem presented by means of pairs of light intensities. We desired to find the subject's method of solution, the number of relative judgments necessary to solution, the time consumed in such solution, and the ability of the subject to transfer from one problem to another, the problem having been changed by the experimenter without notice, the series of stimulus settings remaining the same, and all without the aid of verbal instructions. We desired to investigate problem-solving behavior in which the stimulus setting was as completely as possible under control and each step requiring a correct or incorrect response. The investigation centered about the coming of 'insightful' behavior.

II. BRIEF HISTORICAL BACKGROUND

The present study uses human subjects, but the problem involved finds its sources in both the human and animal experimentation of the past forty years.

In 1911, Hamilton (1) devised a choice apparatus for studying ideational behavior. He found striking differences in the modes of activity of various mammals. His method of experimentation was ingenious and Yerkes (2) took it as the basis of his multiple choice apparatus for testing the mentally defective. We quote from Yerkes' article, "Now it happens this relational method of studying ideational behavior has several points of merit for those comparative psychologists who seek to apply precise methods of studying behavior to the materials of the psychiatrist. These merits, it must be admitted, are not accidental, but instead result from the requirements which I had in mind in devising problems, apparatus and procedure. The most important of them may be described thus: 1. A series of problems ranging in difficulty from the very simply and easy to the extremely difficult may be selected, standardized and presented, either in part or in entirety, to any given subject. 2. Each of these problems is completely soluble by subject with excellent ideational capacity, although not necessarily by a given subject. 3. The attempts of the subject to solve a problem are readily recordable as forms of reaction for the most part as definite choices of objects in a group. The experimenter may, however, make time measurements and keep, if he so desires, detailed records of behavior between choices. 4. Introspective data supplementary to those recorded

(1) Hamilton, G. V., "A Study of Trial and Error Reactions in Mammals." Journal of Animal Behavior, 1911, Vol. 1, 33-36.

(2) Yerkes, Robert M., "A New Method of Studying the Ideational Behavior of Mentally Defective and Deranged as compared with Normal Individuals." Journal Comp. Psychol., 1921, Vol. 1, 369-394.

under (3.) may often be obtained from human subjects. Especially after success in the selection of the right object has been obtained, it is important to request of the subject, if linguistic reaction is possible, a definition of the right object or a description of the method of selecting it. 5. Graphic representations of the process of solution, ideational or otherwise, are possible. Such, for example, are curves of learning constructed on the basis of right and wrong choices, coefficients or indices of ideational capacity may also be used. Likewise formula descriptive of the mode or modes of reaction, reactive tendencies or methods of choice become available."

Yerkes says, P. 379, "Experience indicates that the relational test has considerable value in mental examining as well as varied value as a method of research." His multiple choice method had been used in studying animal behavior by Coburn and Yerkes (3), (4) in the study of the crow and pig, and by Burtt (5) in the study of the white rat, and Yerkes perfected his method in his study of the mentally defective and deranged as compared with normal individuals, and later Brown and Whittell (6) used it in the study of human adults. As early as 1902 Kinnaman (7) had discovered the ability of monkeys to perceive relative brightnesses, and Yerkes (8) found that they possessed a type of ideational behavior. More recent developments have disclosed

(3) Coburn, Charles A. and Yerkes, Robert M., "A Study of the behavior of the crow by the multiple choice method." Jour. Animal Behavior, 1915. Vol. 5, 185-225.

(4) ibid, "A Study of the behavior of the pig Sus Scrofa by the multiple choice method." Jour. Animal Behavior, 1915, Vol. 5, 185-225.

(5) Burtt, Harold E., "A Study of the behavior of the white rat by the multiple choice method." Journal Animal Behavior, 1916, Vol. 6, 222-246.

(6) Brown, Warner, and Whittell, Florence, "Yerkes' multiple choice method with human adults." Jour. Comp. Psychol., 1923, Vol. 3, 305-318.

(7) Kinnaman, A. J., "Mental Life of two Macacus Rhesus Monkeys in Captivity." Amer. Jour. Psychol., 1902, Vol. 13, 98-148, 175-218.

(8) Yerkes, Robert M. "The Mental Life of Monkeys and Apes: A Study of Ideational Behavior." Behavior Monographs, 1916, iii, No. 1,

certain abstractive ability in apes, as Révész (9) discovered, but it remained for Köhler (10) to do his monumental work with apes in which he found insightful activity in the perception of relationships and objects-in-relation to goal activity.

More recently Helson (11) described the presence of insight in the white rat, and passing down the scale to the goldfish, the 1930 study of Wheeler and Perkins (12) shows definite insightful activity in the learning of the goldfish.

Turning to human subjects in the matter of puzzle solving we note the investigations of Lindley (13) and Book (14) and come to the crucial examination in the work of Ruger (15) who studied twenty-five subjects in the process of solving mechanical puzzles. He found much random exploratory behavior, a large proportion of first solutions seemingly being accidental. He found frequently a sudden and permanent drop in the learning curve. The learning of his subjects in many ways presented similarities to the behavior of animals. He found attitude to play a large part in the effectiveness of the analysis. The reports of his subjects seemed to reveal, so he thought, many processes which might be classified either as perception or reasoning. He made out the case for transfer which he attributed to similarities between situations.

(9) Révész, G., "Experimental Study in Abstraction in Monkeys." Jour. Comp. Psychol, 1925, Vol. 5, 293-341.
(10) Köhler, Wolfgang, "The Mentality of Apes. (E. Winter, Tr.) London, 1925.
(11) Helson, Harry, "Insight in the White Rat." Jour. Exp. Psychol., 1927, Vol. 10, No. 5, 378-396
(12) Wheeler, R. H. and Perkins, F. Theodore, "Configurational Learning in the Goldfish." Comp. Psych. Monographs, 1930, Vol. 7,No. 1, 1-50
(13) Lindley, E. H., "A Study of Puzzles," Amer. Jour. of Psychol., 1897, Vol. 8, pp. 431 ff.
(14) Book, W. F., "Psychology of Skill." N. Y. Gregg, 1925.
(15) Ruger, Henry Alford, "The Psychology of Efficiency." Archives of Psychol., 1910, No. 15.

Wyatt (16) in his analysis of Ruger's experiment says, "The moment or act of insight can only sometimes be described as a sudden flash; it is often a succession of glimmering apprehensions and is found in all degrees, from elusive and indefinite dimness to a clear and convincing definiteness."

In this experiment we are carefully considering the views of insight taken by Köhler (17) and defined by Helson (18). "Insight," says Helson, "may be defined in a number of ways and may be tested through a number of criteria, such as ability to respond to a part in the light of a whole, modification of activities to meet the exigencies of a situation in a manner we may call sensible, or the transposition of the general properties from one situation to another; but in no case do we mean by insight any mental process, a peculiar vitalistic entelechy or anything not objectively observable.

An excellent review of Ruger's work is found in Murphy (19) which is general and historical. The Gestalt conception and interpretation of Ruger's work may be found in Köffka (20) and the recent Organismic view in Wheeler (21), while arguments opposed to this conception are given by Hunter (22) in his article on "Experimental Studies of Learning."

(16) Wyatt, H. G., "Intelligence in Man and Ape." Psychol. Rev., 1926, 33, 375.
(17) Köhler, op. cit.
(18) Helson, op. cit. p. 380.
(19) Murphy, Gardner, "An Historical Introduction to Modern Psychology." N. Y. Harcourt, Brace and Company. 1929.
(20) Koffka, K., "The Growth of the Mind." (Ogden, Tr.) 1927, p. 174 ff.
(21) Wheeler, Raymond Holder, "The Science of Psychology." 1929. Crowell, New York, p. 126 and see index.
(22) Hunter, Walter S. in "The Foundations of Experimental Psychology." Article on "Experimental Studies of Learning." p. 575

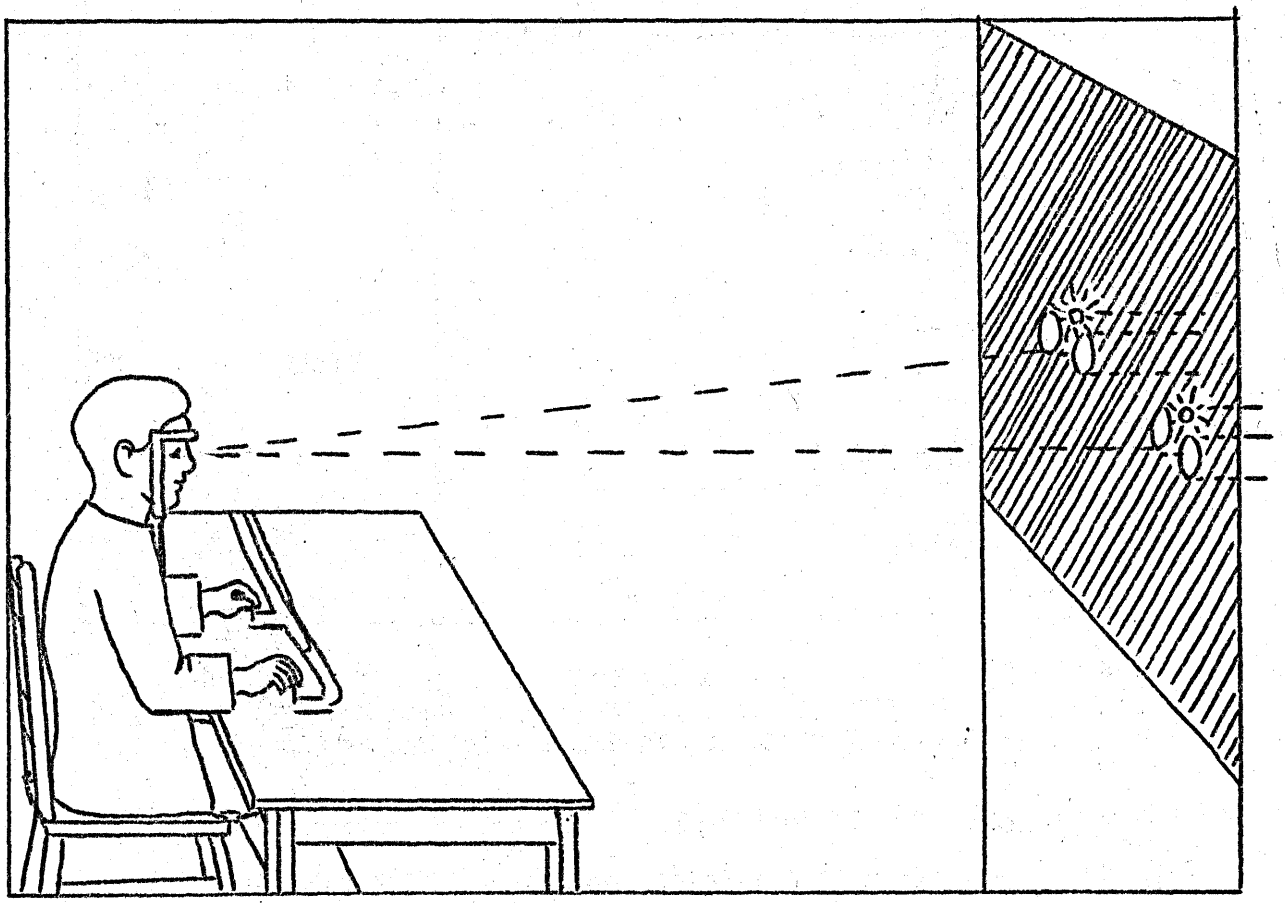


FIGURE 2

III. DESCRIPTION OF APPARATUS

A visual patter (Figure 1) was prepared consisting of two pairs of apertures in a black cardboard screen. The apertures were round $2\frac{1}{2}$ inches in diameter; the members of the pairs were 1 7/8 inches apart and the pairs 8 inches apart. Behind each aperture was mounted a milk glass plate. Just above and between the members of each pair was mounted a miniature light bulb for a signal light. The rest of the visual field was black. The lights were placed on a level with the eyes of an average person seated, or 17 3/4 inches above table level. The position of the subject (Figure 2) was arranged at a table with a distance of 54 inches from the presentation screen to the subject's eyes. A headrest was used. Two keys similar to telegraph keys were

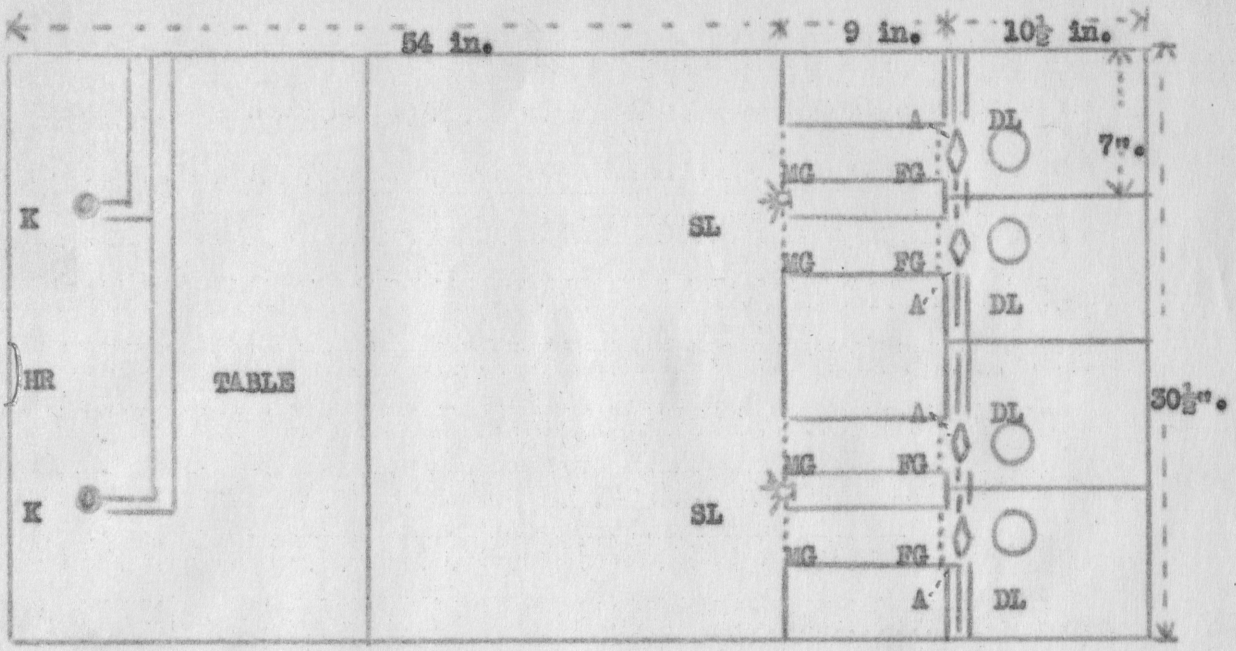


FIGURE 3

KK,-keys. HR,-headrest. SL,-signal lights. MG,-milk glass. FG,-frosted glass. A,-Aubert diaphragm. DL,-daylight masda light bulbs.

mounted upon the table in a position convenient to the subject's hands and were connected with the appropriate signal lights. Behind the milk glass plates were tubes 3 inches in diameter and 9 inches long of white asbestos material to provide diffusion. To remove shadow from the milk glass cast by the Aubert diaphragms when nearly closed, thin frosted glass plates were used in fromt of the Auberts. This made a double filter and gave even illumination of the milk glass at all intensities. Aubert diaphragms of special construction were used to vary the light intensities. These were constructed in such a way that sliding controls with scaled metric readings made accurate settings possible and provided a gradation of intensity from no light to very bright. Behind the Aubert diaphragms four asbestos lined compartments contained the 150 watt daylight bulbs mounted and carefully centered. A variation in the quality of light of the first masdas tried made it necessary to carefully match four of the same quality so that the subjects might detect no difference in quality. Ventilators were placed over each light.

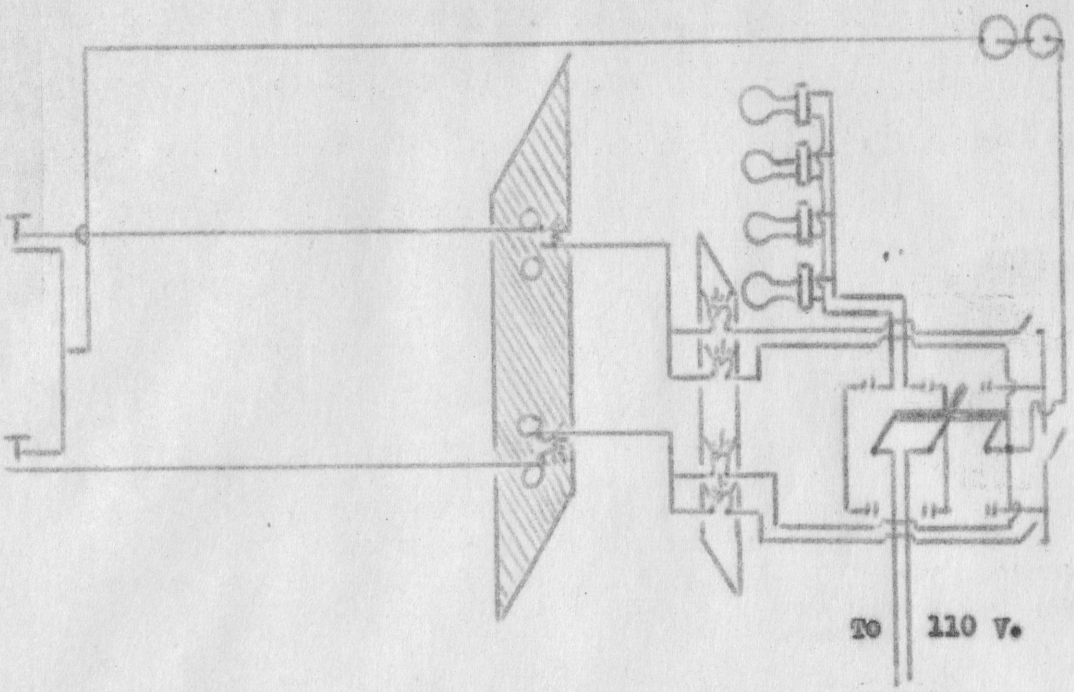
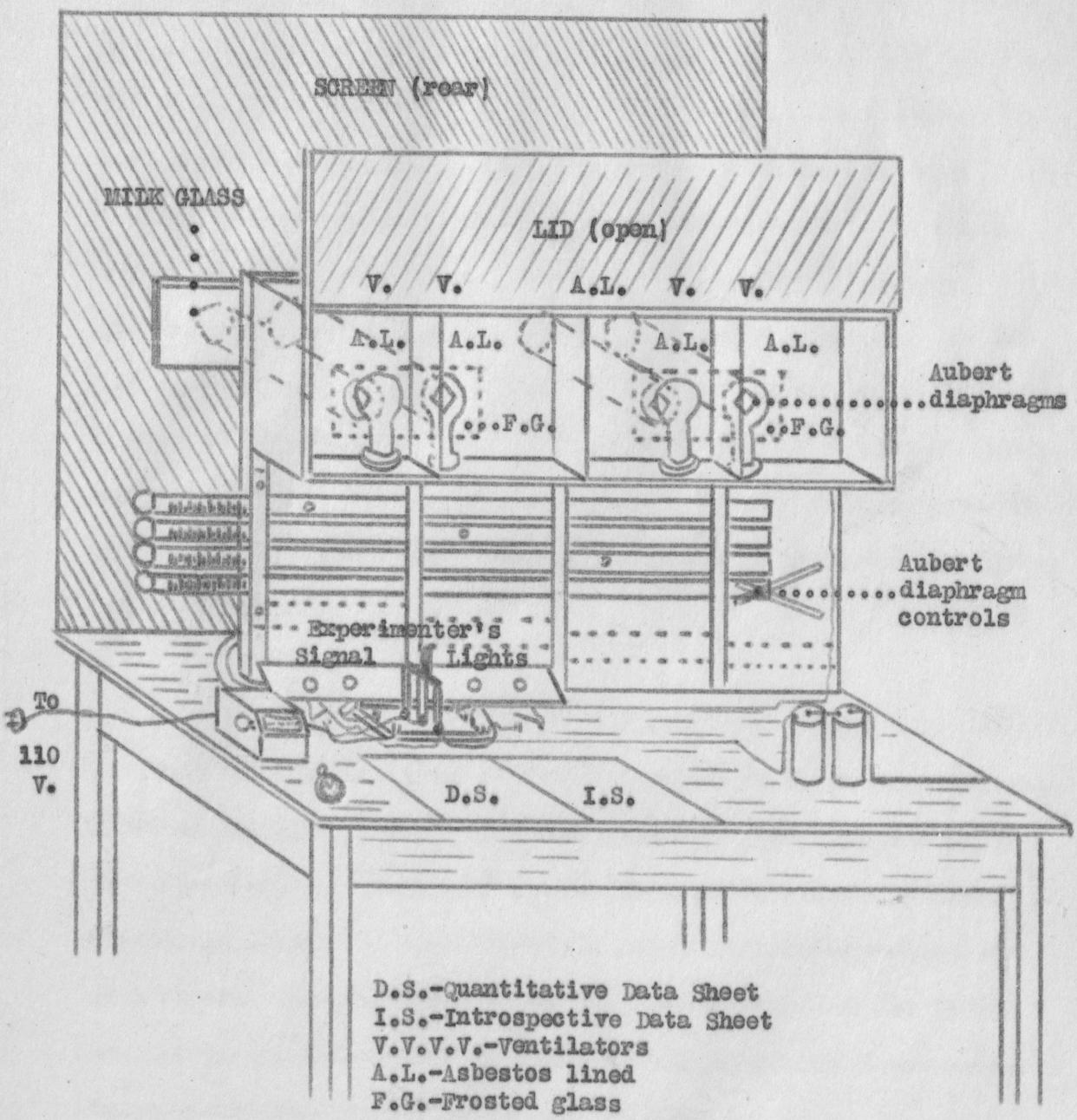


FIGURE 4

The wiring of the apparatus (Figure 4) was so constructed that a main switch, three pole, double throw, would cause the right or the left side to be correct and to permit the subject by pressing the key on the correct side to light a signal light above the correct pair. Also little signal lights before the experimenter on his table informed him as to the correctness or incorrectness of the response made and the time of response. A correct response caused two little lights to light on the appropriate side, and an incorrect response caused only one of the little lights to light on the appropriate side. These lights were all miniature size and operated from two dry cells. Time was carefully kept with a split-second stop watch. A rotating device on the experimenter's table was used to present the intensity settings one at a time to the experimenter in order that the presentations might be given in order according to the carefully prepared list.

On the following page we present (Figure 5), a rear view of apparatus.



PRESENTATION APPARATUS (rear view)

FIGURE 5

Much time and careful preparation was expended in the preparation of the list of intensity settings. A Basic Table (Table I) containing a series of twenty presentations was devised in which Greater Difference was the correct solution and which same list would also serve in the later Lesser Summation problem. In this Basic Table, numbers 1-15 were different and numbers 16-20 repetitions of numbers 3, 6, 8, 11, and 12. The intensities used fall into seven categories as follows: High Bright (HB), Bright (B), Low Bright (LB), Medium (M), High Dim (HD), Dim (D) and Low Dim (LD). High Bright was full intensity of the 150 watt Masda daylight bulbs out down by the thin frosted glass and milk glass and the distance, and was a very bright circular disc of light, but not so bright as to be irritating to the eyes. Low Dim was a disc of just discernable light. The steps intermediate were easily differentiated by all the subjects.

IV. EXPERIMENTAL PROCEDURE

The subjects consisted of thirty individuals as follows, fifteen males and fifteen females. Six were engaged in post graduate work. Three were college graduates. Twelve were undergraduates from the psychology classes in the University. Seven were students from the High School. One was from the eighth grade and one from the first, and for a special test one four-year-old pre-school child was used. The subjects were chosen because of availability.

The Method of Procedure.

A dark room was used. The subject was seated comfortably before the observation table, and the head rest adjusted. The hands were placed upon the table and the fingers upon the keys. The subject

TABLE I

SERIES OF INTENSITY PRESENTATIONS. BASIC TABLE.

No.	Pair A		Pair B		Correct Greater Difference	Correct Lesser Summation
1	HD	LD	LD	HB	B	A
2	HB	LD	HD	HB	A	A
3	HB	LB	M	LD	B	B
4	B	HB	LD	B	B	B
5	HB	D	HD	D	A	B
6	LB	D	M	B	A	A
7	HD	HB	HD	D	A	B
8	HB	LB	HB	D	B	B
9	LB	HB	HD	HD	A	B
10	LB	HD	LD	B	B	B
11	M	B	M	LD	B	B
12	D	LB	B	B	A	A
13	M	LD	B	HB	A	A
14	HB	HB	LD	LD	Neither	B
15	D	HB	LD	HD	A	B
16 (3)	HB	LB	M	LD	B	B
17 (6)	LB	D	M	B	A	A
18 (8)	HB	LB	HB	D	B	B
19 (11)	M	B	M	LD	B	B
20 (12)	D	LB	B	B	A	A

High Bright (HB)
Bright (B)
Low Bright (LB)
Medium (M)
High Dim (HD)
Dim (D)
Low Dim (LD)

Presentations No. 21 to No. 60 were given following the correct solution of the Greater Difference Problem in which the Basic Table given above was repeated but with a different order and with intra-memberal transposition of items in the pairs. The object of giving these forty presentations was to train the Subject to respond to Greater Difference under a variety of presentations. Following this series and without warning the Subject was presented with the Basic Table again, but with Lesser Summation as the correct solution. This was to reveal the Subject's facility in re-learning and to obtain data upon the matter of transfer.

was given no verbal instructions. The four lights were already turned on equally when the subject came into the room. The subject was shown the use of the keys in lighting the signal lights by non-verbal demonstration. The subject was then asked to describe the situation. The words, "Please describe the situation in which you find yourself and what do you see?" were used. To the question invariably asked, "What do you want me to do?" the reply was, "As the experiment proceeds please respond in any way you think best." Also, "When asked to describe during the course of the experiment, please do so, and tell just what is in your mind and why you respond as you do." The subjects very frequently volunteered information during the experiment without the experimenter asking for it. With the subject as nearly at ease as possible, the lights were switched off and the first presentation set and switched on.

The Method of Recording.

Two pages lay on the table before the experimenter, one a quantitative data sheet (Figure 6) and the other a sheet for introspective and other qualitative data. All important observations were recorded. On the quantitative data sheet the correctness or incorrectness of the response was indicated by a plus or minus followed by the time interval accurate to the fifth of a second. The first key pressed was taken as the response. On the presentation of Number 14 which consisted of two pairs of equal intensities, the subjects characteristically pressed both keys simultaneously when they had solved the Greater Difference problem. A few spoke up and said, "Neither is correct."

No.	Name	Sex	Age
	Date	Time	Tr. Untr.

	A	B	C	D	E	F	G	H	I	J
1										
2										
3										
4										
5										
6										
7										
8										
9										
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11										
12										
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14										
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16										
17										
18										
19										
20										

21		26		31		36		41		46		51		56		
22		27		32		37		42		47		52		57		
23		28		33		38		43		48		53		58		
24		29		34		39		44		49		54		59		
25		30		35		40		45		50		55		60		

FIGURE 6

V. PRESENTATION OF RESULTS

(1) Quantitative Data. (Statistical)

On the following page we present Table II which is a summary of the statistical data taken from the data sheets of the thirty subjects. The subjects are presented in this table in the same chronological order that they were put through the experiment. The first work on the experiment was done during the spring semester of 1928-1929. The apparatus was planned and constructed and the first experiment was conducted May 24, 1929. The thirtieth subject was put through the experiment August 9, 1929. Table II shows the number of the subject, the age, sex, school status, total Greater Difference presentations before solution or full insight, the number of correct and the number of incorrect choices, the total Lesser Summation presentations before solution or full insight and the number of correct and incorrect choices. The footnotes to the table explain the irregularities in the table. Number one did not fully solve the Lesser Summation problem so far as giving a clear verbal statement is concerned, but after 75 presentations while declaring that there was no solution nevertheless gave a record of approximately correct choices. Number eight, as Table III shows, was the quickest of the thirty subjects in average reaction time. He was unable to stay to complete the experiment and returned another day for another sitting, and finished at a third sitting, which made his work long drawn out and unsatisfactory. His reactions were too quick to be accurate.

In Table III we give an analysis of the reaction times of the subjects. Total and average time for the first problem is given, average time for the Training Series, and total and average time for the second problem, and total time of all presentations and the subject's average.

TABLE II

STATISTICAL DATA

No.	Age	Sex	School Status	Total G. D. to Insight	Plus	Minus	Total L. S. to Insight	Plus	Minus
1	19	M	C	23	13	10	75*	50	25
2	20	M	C	66	54	12	15	12	3
3	20	M	C	42	21	21	7	4	3
4	14	M	H. S.	81	56	25	31	23	8
5	16	F	H. S.	80	53	27	52	39	13
6	16	F	H. S.	66	41	25	78	60	18
7	20	M	C. P. G.	6	3	3	46	29	17
8	20	M	C (Summer)	315*	149	156	82	52	30
9	21	M	C (Summer)	100	61	34	15	9	5
10	22	M	C (Summer)	89	43	26	49	43	6
11	26	M	P. G.	6	0	6	14	9	5
12	14	M	G. S.	94	38	56	22	13	9
13	28	M	P. G.	114	70	54	38	19	19
14	65	M	C (Summer)	74	50	24	35	20	15
15	35	F	C (Summer)	78	37	41	37	23	14
16	28	M	C (Summer)	110	82	28	*No L. S. given		
17	20	F	C	57	34	23	27	20	7
18	20	F	C	40	25	15	35	24	11
19	37	F	P. G.	36	21	15	29	20	9
20	20	M	C	40	31	9	*No L. S. given		
21	40	F	C. G.	33	22	11	30	21	9
22	16	F	H. S.	64	38	26	16	11	5
23	22	F	C. G.	40	26	14	22	13	9
24	7	F	G. S.	112	65	49	30	24	6
25	4	M	P. S.	*	48	32	*No L. S. given		
26	18	F	H. S. G.	60	36	24	20	11	9
27	16	F	H. S.	60	40	20	*No L. S. given		
28	27	F	P. G.	40	28	12	20	14	6
29	25	F	P. G.	38	18	20	14	9	5
30	24	F	C	56	35	21	31	20	11
				2077	1237	840	869	592	277
			Approximate ratio		60 / 40			68 / 32	

Legend: M, Masculine. F, Feminine. P. S., Pre-school. H. S., High School. C, College. C. G., College Graduate (not in school) P. G., Post Graduate (enrolled) G. D., Greater Difference L. S., Lesser Summation

*No. 1 made no complete solution of the L. S.

*No. 8 gave a series of short sittings which proved unsatisfactory and helped lengthen the time necessary for solution.

*Nos. 16, 20, and 27 had to leave before the L. S. could be completed.

*No. 25, a four-year-old child, became restless and very tired in the dark room after 80 presentations and the attempt was abandoned.

TABLE III

REACTION TIMES

No.	Greater Difference Total time seconds	Greater Difference Average time seconds	Training Series Average time seconds	Lesser Difference Total time seconds	Lesser Difference Average time seconds	Total Total time sec.	Total Aver. time sec.
1	250	10.86	3.94	473	6.30	880.8	7.03
2	327	4.95	2.87	44	2.93	485.8	3.58
3	226	5.38	1.64	35	5	326.6	4
4	289	3.56	4.22	112	3.61	570	3.98
5	542	6.69	2.35	100	1.92	736.2	3.65
6	176	2.66	1.94	207	2.65	460.8	2.41
7	23	3.83	1.32	119	2.58	195	2.57
8	421	1.27	1.25	74	.9	478.4	1.14
9	228	2.28	2.46	31	2.21	357.6	2.31
10	162	1.82	2.61	96	1.95	362.6	2.12
11	66	4.9	1.67	53	3.78	186	3.45
12	367	3.9	1.54	43	1.95	471.8	2.46
13	956	8.38	5.16	220	5.78	1382.4	6.44
14	480	6.48	1.97	137	3.91	696	4.12
15	483	6.19	1.99	196	4.9	758.8	4.36
16	534	4.85					
17	213	3.75	2.32	104	3.85	410	3.3
18	285	7.12	2.72	99	2.82	492.8	4.22
19	216	6	1.7	54	2.03	338	3.24
20	113	2.82					
21	136	4.12	2.02	80	2.66	296.8	2.93
22	410	6.4	2.52	53	3.31	563.8	4.07
23	145	3.62	2.15	77	3.5	308	3.09
24	438	3.91	3.4	99	3.3	673	3.53
25	297	3.71					
26	233	3.88	1.74	44	2	346.6	2.54
27	176	2.93					
28	Data sheet lost before reaction times were tabulated						
29	185	4.86	1.35	30	2.14	269	2.78
30	299	5.33	1.92	56	1.8	432	3.01

Time, in the above table, is in seconds and tenths of a second. The time during which the subject was surveying the visual stimulus patterns is the basis of this table and not the intervals between presentations while the experimenter was arranging a new setting. No. 8 has the quickest reaction time as fast as 2/5 sec., and No. 13 has the slowest, or an average of 6 2/5 sec. and neither one has a high performance rating.

(2) Quantitative Data. (Graphic)

The experiment revealed the possibility of plotting three curves for each subject, the Basic Performance Curve based on correct and incorrect choices, the Learning Curve derived from it, based upon the percentage of correct choices in groups of five, and the Time or "Skyline" curve of Reaction times in seconds. This "triple curve" method reveals striking similarities in a few cases and in others

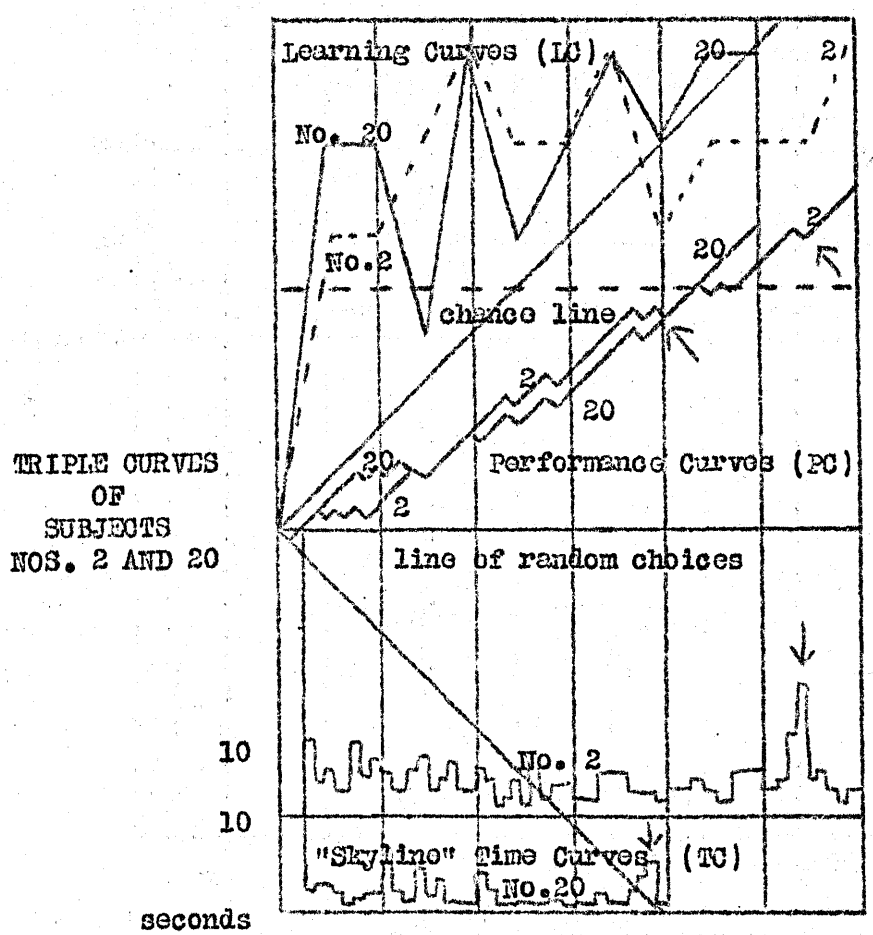

FIGURE 7
The arrows show point of solution (full insight)

wide differences. To illustrate similarity we present Figure 7 above, the Greater Difference Performance curves of Nos. 2 and 20, both University students of comparable standing. The arrows point to the point of solution or insightful behavior. On the following page

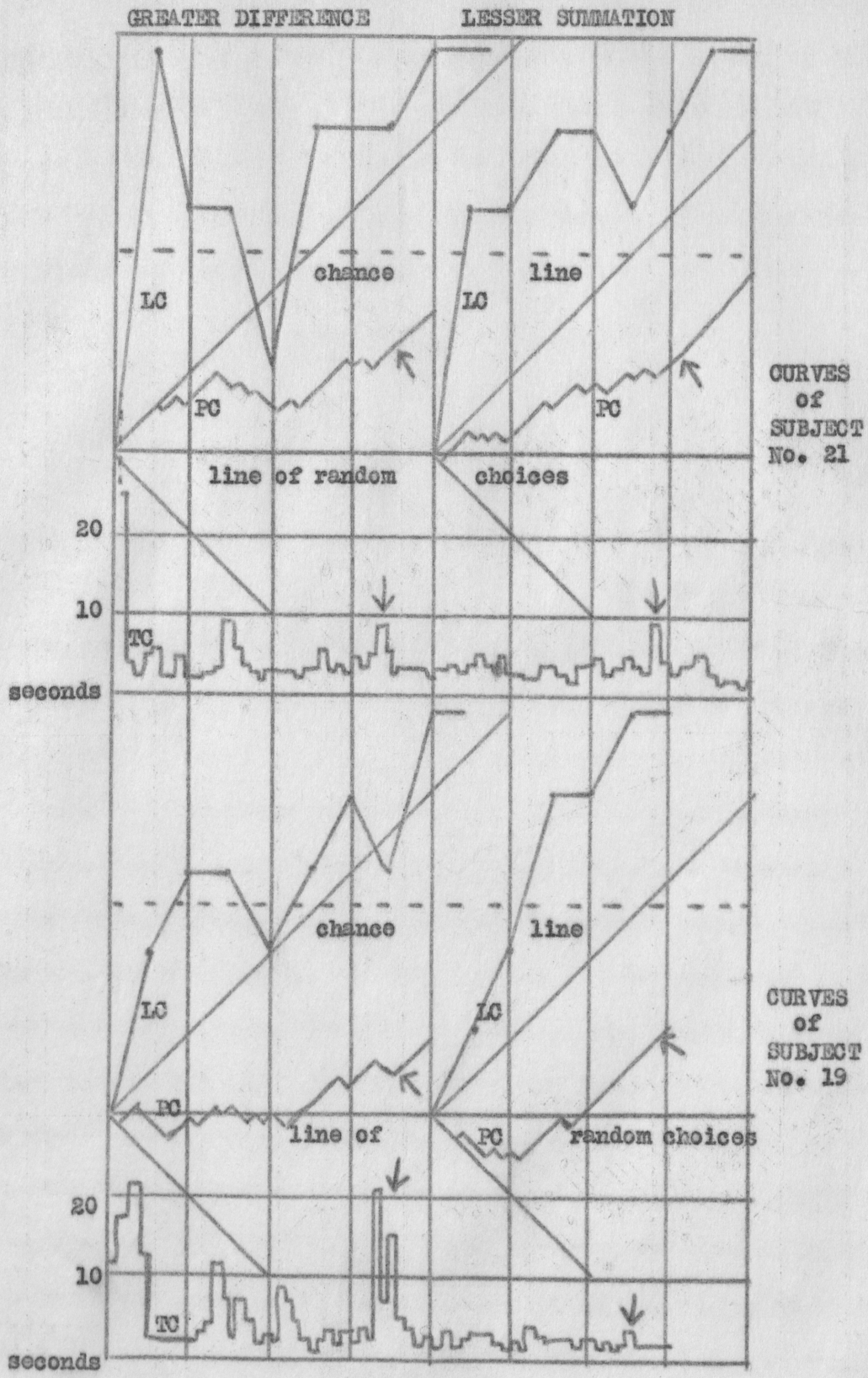

FIGURE 8
LC,-learning curve. PC,-performance curve.
TC,-time curve.

is shown in Figure 8, the Triple Learning, Performance, and Time Curves of subjects No. 19 and No. 21 showing variations and clearly indicating in the "Skyline" time curve the "Skyscraper" pause before solution. This pause, or "Initial Delay" is similar to Snoddy's (23) discovery of initial delay in mirror star-tracing. Our subjects invariably made this very noticeable pause.

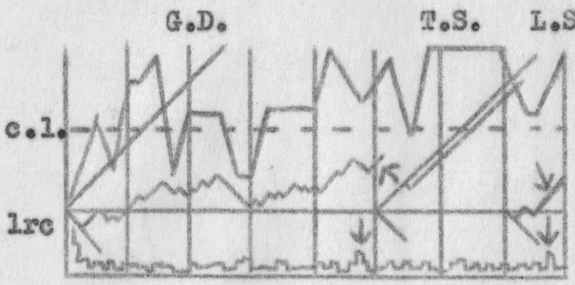

FIGURE 9

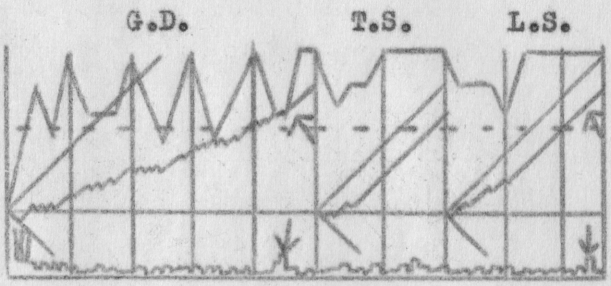

FIGURE 10

In Figures 9 and 10 above, we have the Triple Curves of subjects No. 9 and No. 10 (see Table II) showing chance line for the learning curve, random choice line for the performance curve and the peaks in the time curve just before full insight. Under G. D. is the curve of solution of the Greater Difference problem. T. S. is the training series, forty presentations in which mistakes occurred due to too quick responses, and L. S. is the Lesser Summation (second) problem. c. l. is chance line. l. r. c. is line of random choice. Figure 9 shows insight after a drop in performance curve and Figure 10, shows insight emerging from a curve of steady and gradual rise.

As a check on introspective data we prepared a chart of performance curves for the first 20 basic table items showing the curve which would result from various plans or schemes which the subject might try before arriving at the correct solution. We found that choice of the brightest

(23) Snoddy, G. S., "An Experimental Analysis of a Case of Trial and Error Learning in the Human Subject." Psy. Mon., 1920, Vol. 20, No. 124.

member would result in a falling performance curve ending 2-6 steps below starting point. Choice of the dimmest member would end 8-14 steps above. Greatest Difference would of course be the solution and would be ended 20 steps above. Choice of Lesser Difference gives a drop of 20 steps. Choice of Least Summation (incorrect in first problem) would give a rise of 8 steps. Greater Summation would give a fall of 10 steps. Choice of intermediate intensities gave 2-10 steps below. By this means we could check introspective data and arrive at a conclusion as to what was the probable schemes which the subject was trying. This check will form a valuable asset in further experimentation upon animals where introspective data will be lacking. We think this a most important finding in methodology for comparative psychology.

As a check upon the experiment and to corroborate the 50/50 line of random choice we experimented with a subject by giving him the problem without signal lights to indicate correctness or incorrectness of choices. It was a blind alley experiment and resulted after 50 presentations in a return to the random choice line, or a ratio of 25/25. We are not sure that this would always occur as a subject would eventually begin to respond to a self-constructed clue. This presents another most attractive lead for further experimentation.

Incorrect choices in Figures 9 and 10 were due, sometimes to careless observation, sometimes to too quick responses, and a few times, in other subjects, to defective eyesight. The subjects, following a mistake in the training series, invariably gave the reason for the mistake, as the introspective data will show.

(3) INTROSPECTIVE AND QUALITATIVE DATA

We present typical introspections of the subjects during and following the solution of the problem. At critical times during solution and as soon as possible after the behavior of the subject indicated that the problem had been solved introspective data was called for and recorded by the experimenter.

No. 1. After 23rd presentation. G. D.-(solution) "If the successful reaction brings the light, I think I have discovered the correct solution. It is a reaction to the pair which in each presentation seems to hold the same relative position or relationship. In the pair selected there is greater variance between the components of the correct pair than there is in the case of the other pair and the two components of the unselected pair are more similar in intensity or brightness."

In the second problem (L. S.) this subject did not discover the correct solution the first time it was presented. "I think something has gone wrong with your signal lights. I am disregarding them now and am still operating upon the same plan." Another sitting was arranged and the final result was that the subject's behavior came to a correct solution, but the statement was "that isn't according to my principle but is correct according to the little lights. I've tried all along to look for another principle, but can't seem to see it."

As this subject was the first one tried we did not continue until a correct statement was added to the correct behavior in solving the problem, as we did in subsequent cases.

No. 2. After 66 presentations states G. D.-(solution) "I am correct when the ratio is greater than that same ratio in the other one. When

neither light lights, those ratios are equal. You could state that another way. The pair producing the greatest contrast is the correct pair." In the Lesser Summation problem (solution) "It's the side that has the dimmest light, but exceptions occur. It's the two together which are dimmest."

No. 3. G. D.-(solution) "I am reacting to the greatest difference in a pair." L. S.-(solution) "The dimmest pair is the solution."

No. 4. G. D.-(solution) "If the darkest and the lightest are both on one side, it is right. If both sides are equal, neither is correct." L. S.-(solution) "The side with the darkest one or ones is correct."

No. 5. G. D.-(solution) "The brightest and the dimmest eye go together. An equal pair are never correct." L. S.-(solution) "The pair that has the dimmest lights."

No. 6. G. D.-(solution) "When the brightest and the dimmest are on one side, that's the side." L. S.-(solution) "It's the dimmer pair. I mean the two together are dimmer."

No. 7. G. D.-(solution) "It's the dim member and the bright member, the largest difference. The side that has the greater difference or the largest phenomenal difference." L. S.-(solution) "It's the dimmest set of two lights taken as a whole. The configuration that has the least brightness."

No. 8. G. D.-(solution) "Well, it is the pair with the most difference in intensities. That is the proper one. I didn't reason it out at first. Then I thought of the brighest light. Then I thought you were trying to form a habit and were changing them as you pleased.

Then I tried memory, north side, south side, and how many times. Then it came to me all of a sudden. As soon as I described, I saw it." L. S.-(solution) "It is the single dim light, or something on that order. It's the two dim ones or the dim one."

No. 9. G. D.-(solution) "I've thought of a possibility. I have a hunch. The idea came and sort of cleared up. It is the side with the greatest difference." L. S.-(solution) "It's the pair that has the least light of all, as a whole. It is the side that does not seem to have a very bright light in either one. The correct pair doesn't have as much light as a pair."

No. 10. G. D.-(solution) "The two on the left are about equal. The two on the right have a wide difference. That is, I'm hitting the side that has the greater difference between the two lights." L. S.-(solution) "I pressed the side that had the single dimmest light and then the dimmest pair which is correct, I'm sure."

No. 11. Trained observer. G. D.-(solution) "You react to the pair with the greater difference in intensities. A knowledge of psychology in general would help in this experiment. In looking between them (the pairs) it is a total situation, a unity, the whole thing." L. S.-(After 7th presentation) "Oh, oh, I see what you're doing. Wait a minute. You are adding another complication. Here's what you could be doing. Wait, I'll try the next one. I have a notion. I tried least difference. I guessed wrong. Its a process of elimination." (After 14th presentation--solution) "I chose the least total brightness." Final statement: "An interesting problem grows out of this. A curve of responses could be plotted. Another thing, the bright pair pulls, the eye turns to the bright light."

No. 12. A grade school boy. He tried various schemes. A. 14, "I'm not getting them right." A. 19, "I don't know. Is there a plan?" B. 5, "I used the bright light, then the opposite." C. 9, "I did the wrong one, but I've thought of a plan that worked once or twice. When a bright one and a dim one are together in a pair, it worked twice." (Did not stick to this solution) D. 20, "I haven't got the plan yet." E. 14, (solution) "I think I have it now. It's the one where there's the most difference between the shades of light." L. S.--"That's different. Have you changed it?" F. 5, "I pressed the one that had the most difference. You've changed it to the one with least difference haven't you?" F. 6, "Least difference didn't work that time." F. 7, "Is it the one with even lights?" F. 16, "Leave it on a little until I see if I can figure it out. All right, I think maybe I've got it." G. 2, "It's the two dimmest lights." (Final statement) "The first was hardest. It took me longer to learn it. After I learned it I could get on to the last one easier. The pair of dimmest ones is correct for the last while, the most space between, the most difference in intensity was first."

No. 13. At first attempted the subjective attitude. Described feelings and impressions. He said, "I'm not attempting to reason. I'm in a receptive attitude. I feel this light will light. I'll try it. Well, it didn't light. I am disappointed." Describes disappointment in terms of feeling tone, etc. Later he tried memory. At B. 7, he asked, "Am I giving you any introspections that are good. It's all feeling, not reason." (Later) "I'm verbalizing." Not until F. 15 does he exclaim, "It is greater difference, the group to the left. Insight floods consciousness. It's not strictly phenomenal. It's partly

reasoned out. I have a feeling that I think I've solved it. I see where I made my mistake. I was more interested in my own introspections. I was biased, but the solution came as a sudden flash. I took a passive receptive rather than an active striving attitude. That fooled me." L. S.--"There's a new problem here." H. 18,-(solution) "It's the pair opposite the two bright ones. It's the dimmest pair. (Final statement) "It is a total configuration made up of two natural parts or pairs. The solution came as a sudden flash. I saw the solution and the past course did not enter in so far as I can see now."

No. 14. (An old gentleman) At D. 14, a sigh indicated the presentation of the even pair. No response. At D. 20,-(solution) "I was working on the pair with the greatest difference." L. S.--G. 14, (solution) "The pair nearest opaque brings the correct response, the pair that has the least amount of light. (Final statement) "I questioned the manipulation at first on this problem. It was quite a while before I tried to study out the new solution. When it came it seemed to come all at once, suddenly. It's a matter of judgment. I had a hunch before that the solution was correct. It is really inexplainable. It may be a feeling or result of a feeling. When you changed the problem I questioned the manipulation quite awhile before I tried to study out a new way. The solutions came at once, suddenly. I had had a sort of hunch all along that I was getting it. It's really inexplainable."

No. 15. (Preliminary statement) After trying memory schemes and brightest single member, and darkest member, said, "I'm starting all over" and at C. 5, said, "The one that has the highest and lowest in the pair." He did not keep responding correctly. Later, "I have an idea I can't express." At C. 19, (solution) "It's the pair with the

different values or the greatest range." L. S.--At E. 2, "It isn't the same problem." At F. 2, "No principle occurs to me yet. I've tried greatest and smallest range. At F. 17, (solution) "The darker of the two pairs, taking the pair as a whole." (Final statement) "At first it struck me as a whole situation, then as four lights with differences in values and later the two pairs was thought of and finally equalities and inequalities as containing a problem to be solved. Each situation seemed new until insight entered. I thought the bright side pulled at first."

No. 16. Preliminary observations: "I see four circular lights. Nothing else in particular." This subject adopted a complex memory system and after the third time through had discovered the repetition of various patterns. His near solution of the problem after the fifth time through was as follows: "The light varies inversely. If two and four counting from the south are bright, the south lights. If the second from the north is bright the north lights. If the two on each side are equal, no light. If the second from the south is bright, that side lights, etc." The final solution came when the subject discarded the memory system and adopted the problem-solving attitude. His memory system was a hindrance rather than a help to the complete solution. This subject was called away and did not complete the training series or the L. S. series.

No. 17 Preliminary observations: "I see four lights arranged in two pairs." Later, "It looks like relationship between the lights is the problem." G. D.-(upon solution) "It is a bright one and a dark one that is right and not the equal ones." L. S.--The first presentation brought an incorrect response and the subject exclaimed, "What's that?

That changes the thing. Is it supposed to be the same problem?" (Upon solution) "When the pair that is dimmest needs the little light to make them equal to the other pair. Is that it?"

No. 18. (Preliminary observations) "I see little lights. Four lights with black space around. There are two groups of two. (After lights were switched off) "The lights are out, but I can still see where the lights were." (after image) After surveying the first presentation, "I'd like to touch one of the buttons, May I?" At A. 11, "I've been guessing, so far." G. D.-(solution) "The light is where there is the greatest contrast. L. S.-C. 5, "The greatest difference is on the left, but it lights on the right." C. 9, "I've tried least difference, but it doesn't work." C. 13, "I've gone back to greatest difference." C. 20, "Except for exceptions the first principle works. There must be a new plan though." (Solution statement) "It seems the light flashes where the two dimmest ones are. I discovered it on the one with the equality in the pairs the last time for sure." (Final general statement) "It came all at once that it was the intensity. That was the way you decided. It gradually dawned on me that it took two lights rather than one. It is a problem to find out how soon it takes a person to recognize the significance of the lights. When you changed the problem you were trying to see how long it would take me to change my habit. The last problem was easier than the first."

No. 19. (Preliminary statement) "I see a group of white spots. There are two and two. There are four altogether. I am curious what it's all about." G. D.-(solution) "When there's a light one and a dark one, I get a light. But I don't get it when they're the same. The first thing I think of is the bright. Contrast comes as a second

thought." L. S.--C. 1, "You've changed on me." C. 5, "I'm puzzled. Do my eyes deceive me or have you changed?" C. 12, "Are you consistent all the time. That's what I'm wondering." C. 20, "It seems to be the less intense of the four." D. 8, "It's one dark or two dark ones. D. 9, (solution) "It's the two whose sum-total is less than the other two." (Final statement) "I was afraid I couldn't estimate the lights on account of my eyes."

No. 20. (Preliminary statement) "I see two pairs of lights, all the same. They are grouped in two units. That is noticeable." G. D.--A. 14, "I'm trying to equalize. That is my scheme. The tendency is to increase the weaker side, yet I am pulled toward the stronger." B. 20, (solution) "I've got a new rule. The trend of affairs is to pay more attention to the dissimilar pair regardless of the intensities. I violated the equalizing rule and revised my rule. The dissimilar pair is correct."

No. 21. (Preliminary statement) "I see lights, four lights, four in a row." B. 12, "I've lost my bright idea." G. D.-(solution statement) "It's the bigger ratio of difference." L. S.--C. 1, "Why is that? The biggest degree of difference isn't there. You know it isn't. You've changed your stuff." C. 2, "Well, now, that's all right again." D. 5, "It's the least ratio." D. 14, "Well, that pair as a pair is the dimmest. It's the pair with lowest intensity." (Final statement) "The greater difference came, when it came, all at once. The solution of the last problem was more gradual. I made correct responses both times before I realized what made them come right. There was no pleasure in it at first. I was more afraid I wouldn't do it right."

No. 22. (Preliminary statement) "I see four lights, two pairs

of eyes." G. D.--A. 17, "I can't understand it yet. I'm curious. C. 18, "Oh, I can't think. Let's see. The right pair is where one is bright and one is dim." D. 4, "It's the brightest and the dimmest together." L. S.--E. 1, "Well, it looks like that ought to be the other way. E. 9, "I'm working on the basis of the dimmest one. E. 15, "The lowest pair, is that it?" (Final statement) "The brightest light seemed to pull for my response. Sometimes I tried too quickly. I saw the pairs more distinctly than I saw the four altogether."

No. 23. Made no preliminary statement. G. D.--A. 3, "I'm curious and bemuddled, but the light lights above the dimmest." A. 4, "That sort of put a jolt in what I'd thought." (Solution statement) A bright one and a dim one must be on the same side. It's the uneven pair. When there's greater contrast." L. S.--D. 1, "I'm suspicious that my rule has gone blooie." D. 5, "My rule doesn't hold. I've got to figure up a new rule." D. 9, "It's the ones with the same intensity. You are using a different set now." D. 11, "It's always the one to the right. Is that it?" D. 17, "It's the odd one." E. 2, (solution) "It's the pair that is less bright." No final statement.

No. 24. A little girl of seven years, second grade, leading her class, was used for this experiment. She solved the problems. Her introspections are so interesting that we record them all.

(Preliminary statement) "I see eyes. They are every shape and there are four eyes, two on one side and two on the other." G. D.--A. 1, "There's one dark and one light on one side and one dark and one light on the other, but one on this side is darker than the one on this side." (She was pointing) She responded after 44 seconds by pressing side which lit, and without demonstration. A. 3, "The opposite side

lights." A. 10, "It had a bigger light than the others did. This is a good game." A. 13, "That one hasn't any light in one of the lights, has it?" A. 14, "I don't get any light from either side of the eyes. The eyes don't go on on one side very much." A. 16, "I missed that one, but it's fun anyway." (Holds key down while waiting for next presentation) A. 18, "I don't know why I press the side I do. A. 19, "I pressed because one was light and one was dark. The dark one on this side that was right last time. B. 14, "Neither will go on, why is that?" B. 20, "I pressed the darkest one." C. 1, (Made a mistake and laughs) C. 20, "I know a way." (Pressed both keys simultaneously) D. 5, "I can't do it." D. 20, "I just press. I haven't any way." E. 14, (The equal pairs) "I've seen that one three times. It won't light either side." E. 15, (Begins to sing a school song to herself) F. 14, "Aw, I've seen that one before." F. 20, (She had been correct since F. 12) G. D.-(solution) "The light and the dark. The darkest and the lightest go together. Maybe both are light and dark, then the lightest and the darkest. First I thought it was the light one, and then the dark one. I found it wasn't, so I changed to this way and it works." L. S.--G. 5, "I didn't get it." G. 14. "I've seen that before. Well, what makes it light? The two darks lit." (This was the one with the equal pairs.) G. 20, (solution) "I'm pressing the darker side. I started with a dark and a light and now I press two darks. You changed on me a while ago, didn't you?" (Final statement) "Well, first I pressed a dark and a light, and then when you changed it I pressed two darks, or something like that, I don't know. That's all I have to say."

No. 25. (A little boy, aged four, pre-school, was tried. He did not solve the problem. After 80 presentations he became tired and fright-

ened in the dark room and the attempt was abandoned. His curve is a series of plateaus, with a ratio of 48 correct to 32 incorrect responses) (Preliminary statement) "I see a lot of lights. They are pretty lights." G. D.-(After pressing both keys) "I like to do it. What are the round things for that make the lights light up above? What are they for? It's night in here now isn't it? Is it daytime or night-time? I think it's night in here anyway, but it's daytime though. I like to play with these little things." After a running series of comments at B. 6, "I got that one wrong. Well, we can start all over again, can't we?" At C. 10, "I just know which one to press sometimes. Sometimes I know and sometimes I don't know. I'm tired." D. 20, "I'm so tired. I'm too tired to do any more today. I want to go out where it's daytime." (Experiment was discontinued. We desired to see if this would be a pure chance curve. It showed some intelligent responses and was above chance although no solution or insightful behavior as yet had definitely emerged.)

No. 26. (Preliminary statement) "I see white lights. Four lights in a row, arranged in pairs. They seem equal. I don't know what it's all about. I'm curious and timid." G. D.--A. 7, "I was wondering if you were trying to see which hand I used the most." A. 20, "I have no ideas yet." B. 11, "I tried the brightest light, that wasn't it. B. 19, "I'm trying addition, the dimmest pair." D. 4, (solution) "It's the side that has the greatest difference." L. S.--E. 1, "That one seems wrong." E. 7, "I'm trying least difference." E. 20, "It's the dimmest pair." (Final statement) "The correct solutions came slowly, gradually dawned on me. When it came I felt satisfaction. I thought when you changed that I could catch on to the new way easier than the old, and I think I did."

No. 27. (Preliminary statement) "I see a black space with lights in the shape of circles and arranged in pairs. I'm curious and wondering." G. D.-(solution) "Oh, it's to press the bright and the dim side." The subject was called away and did not return to complete the experiment.

No. 28. (preliminary statement) "I see four lights with two specks above and between. The lights are like eyes on your face, two pairs, two and two." G. D.-(solution) "The side I choose is unequal, the most unequal division of light." L. S.--C. 1, "You have changed it." C. 2, "I have gone back to my old course. You were just doing that to see what I would do." C. 5, "Well, you fooled me again." C. 19, "It's another problem and it's the one with least light." C. 20, (solution) "It's the least light for the pair. (Final statement) "Solutions came gradually, were built up, then became sure suddenly."

No. 29. (Preliminary statement) "I see a blackboard with four lighted circles and two pairs of eyes. I'm wondering what it is all about." G. D.--A. 1, "I feel like a telegraph operator." A. 4, "I'm right handed and use the right hand more than the left." A. 9, "I make quick and impulsive reactions. I probably make more mistakes that way." A. 10, "I press the dimmer pair." A. 16, "I'm trying the brightest ones." A. 20, "I'm trying the dimmest one." B. 18, (solution) "It's the side with less equality in intensity. I had a hunch in back of my mind. The solution was gradual." L. S.--C. 6, "I need to get more hunches, I guess." C. 7, "I'm trying the ones more nearly equal." (lesser difference) C. 8, "That don't work." C. 13, (solution) "Those dim ones bring the light." (Final statement) "The solution came as a hunch growing and then broke in with the correct idea. I was timid at

first, but later became so much interested that I forgot timidity."

No. 30. (Preliminary statement) "I see a black screen with two pairs of circular lights. There are two keys here on the table in front of me. There are four lights up there. I am curious and a bit anxious." G. D.--A. 7, "The brightest light gives the little light. A. 20, "The brightest light does not work in all cases." B. 4, "I think now that the light will appear above one bright and one dim rather than a pair where they both are bright or dim." C. 20, (solution) "Greater difference solves it." L. S.--D. 1, "Say, there's greater difference over here." D. 5, "That upsets the whole works." D. 9, "I hate to tell you that I don't think there's anything to it now." D. 15, "Some more of that stuff. I don't know what to press now, except to go by the old theory." E. 1, "Say, can you tell me, is there another theory that I should find?" E. 12, (solution) "The dim side gives the light." E. 20, "It's the dimmer side, that's final." No final statement.

VI. DISCUSSION OF RESULTS

(1) The Meaning of the Upward Trend before Insight as shown in the Composite Graph.

On the page following we present the composite plottings of all the curves (performance) of the thirty subjects, both the Greater Difference curves below and the Lesser summation above. It is at once evident that the average is a gradual rise following a line of ratio of 60/40 in the primary problem and 68/32 in the second problem. In this figure (Figure 11) and the page following (Figure 12) we have indicated the distribution of points of full insight (solution) by black dots (Figure 11) and by lines of angle of rise (Figure 12).

The reader may interpret this rise as he chooses, but we would call attention to the fact that with five exceptions all performance curves rise above the random choice line, some gradually, and some abruptly. The introspections of the five subjects falling below this line show that they tried false clues such as brightest member, greatest summation or intermediate brightnesses, which would give a falling curve. They abandoned these one after the other and discovered the correct solution sooner or later. Very few of the subjects reported random, or hit and miss, trials. All began to solve on an intelligent, or insight-finding basis, very early in the experiment. We could not call this chance, random choice, or "trial and error" as it is commonly interpreted. The nearest to this conception would be "search and success" which is a goal-seeking procedure. Furthermore the subjects knew after each choice whether their choice had been correct or not. In other words, each choice was a goal in itself, and the whole problem was an ultimate goal. Thus we have goal-controlled behavior accounting

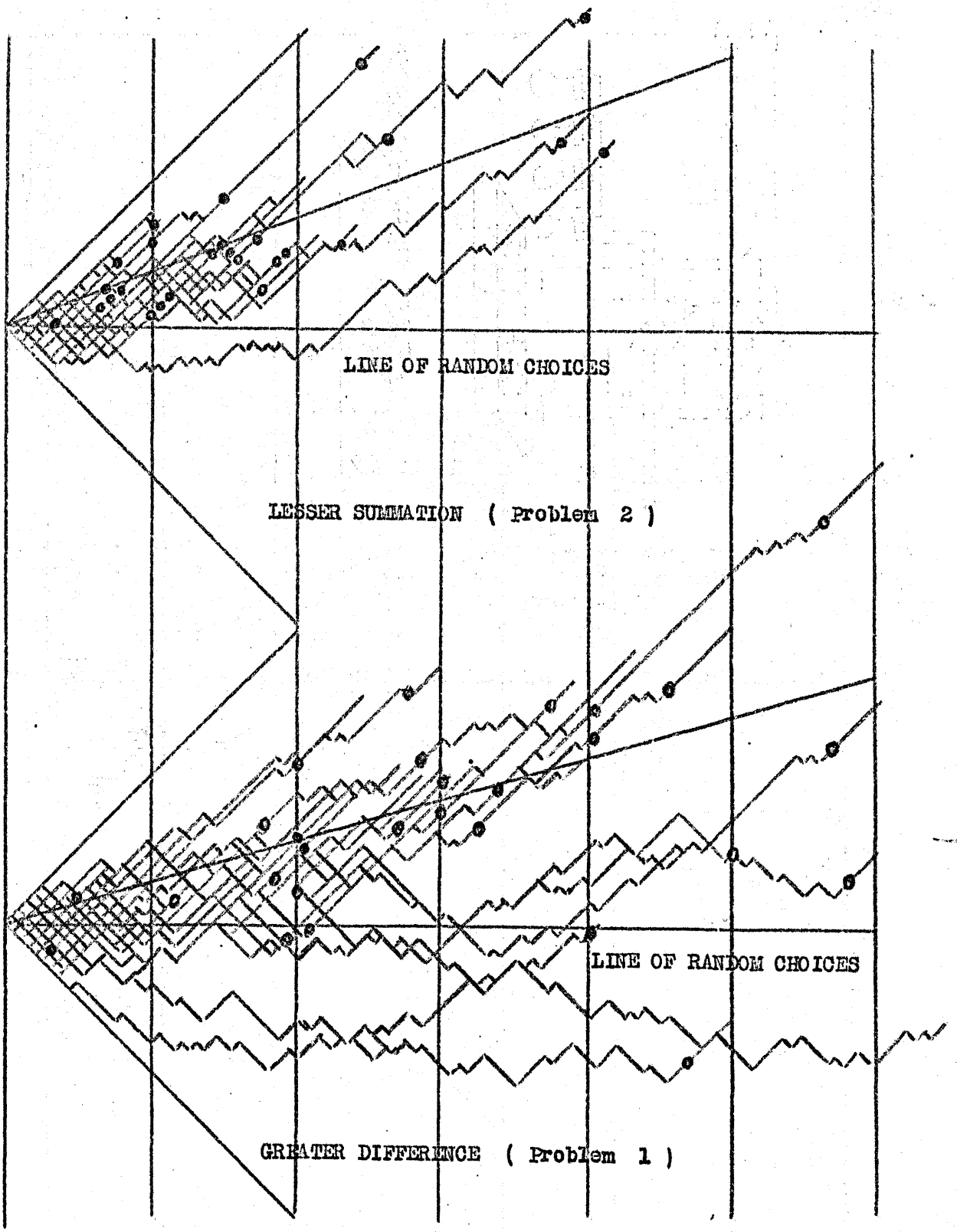

FIGURE 11

Composite graph of the Performance Curves of thirty subjects. The dots show points of full insight (solution).

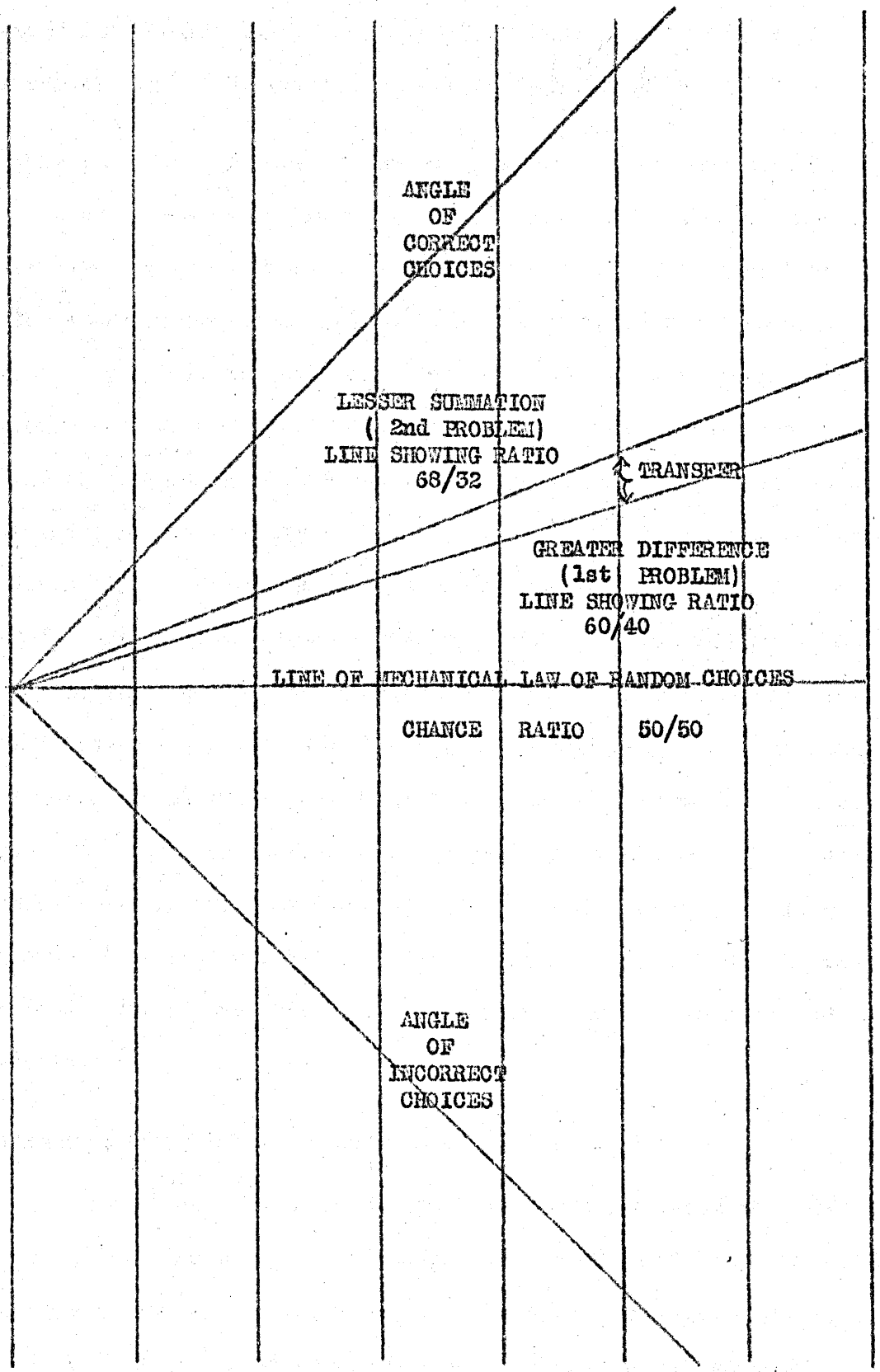

FIGURE 12

Plot of the field of the Performance Curves showing amount of Transfer between the Greater Difference (1st) and Lesser Summation (2nd) problems.

for the upward rise of the performance curve, and the emergence of clearer and clearer insight until at last full insight emerges and the solution is found and behavior thereafter correct.

(2) The Value of the Triple Curve "Picture of Performance" methodology.

We believe we have found a method which should prove of immense value as a technique of approach to the problem of insightful behavior. At the close of the experiment we have a performance curve showing the subject's choices and indicating just what presentation brought what response. We know how many responses were necessary before the subject solved the problem. We have the exact reaction times for each response. Both the performance curve and the reaction times can be recorded automatically if the experimenter so desires. We have later added such devices to our apparatus since the above experiment was completed. We have a learning curve plotted from the subjects performance, and we have introspective data taken before, during and after the experiment, also notes and observations of the subject's behavior made by the experimenter. All this gives a sound basis for the calculation of the subject's problem-solving ability and throws light upon his general intelligence and many other characteristics. Correlation of this Insightful Behavior Quotient with the subject's I. Q. remains for later exposition and investigation.

(3) Reaction Time and its Significance

We have discovered that all subjects begin the experiment with responses of lengthy duration during a period of initial survey. The reaction times then rapidly drop to average or near average giving a "skyline." Just before solution there is a peak or "skyscraper"

indicating "initial delay." Had the experimenter known to watch for it, this pause before insight would have given the clue to the moment of full insight in almost every case. This reaction time curve, while not crucial to the experiment, is nevertheless a valuable addition to the "performance picture."

(4) Transfer.

By our use of this term we do not mean transfer of "identical elements" for this problem is one of transposition and relative judgments. The raising or lowering of the four light intensities, leaving the relationship the same, presents the identical problem in relationships, but a different set of elements.

We find a "transfer effect" as Ruger did. It is a phenomenon of the learning process which Wheeler (24) states is due to "similarity of content," "similarity of methods," and "similar attitudes" in the subject. As a matter of fact we expected a far greater improvement in the second problem than we found by experiment. The ratio of 60/40 and 68/32 (Figure 12) shows the exact amount of transfer effect for the group.

(5) Analysis of the Introspective Data.

Analyzing the introspections of the subjects, the emergence phenomena of insight seem to be as follows: (a) A group of lights are seen against a black field or ground. (b) Then the four lights are seen to be grouped in two pairs. (c) As soon as presentations appear the differentiation of intensity is noted between the members of the pairs. (d) The relationship in one pair is seen to differ

(24) Wheeler, op. cit. p. 302

from the relationship in the other pair. (e) Analyzing the configurations presented the subject's choices are increasingly correct. (f) This process is frequently called "following a hunch" by the subjects. (g) This "hunch" emerges or is developed through analysis. (h) Each relative judgment attains or fails to attain an immediate goal (the lighting of the signal light). (i) Finally, the ultimate goal of the series emerges through analysis into solution and full insight results.

In the change of problems from Greater Difference to Lesser Summation, the subject discovers that there has been a change, questions the procedure, re-analyzes the situation, discards his primary solution and continues his analysis until the correct solution emerges.

In both cases the emergence of full insight may be either rapid or slow, abrupt or gradual, simple or complex, and seems to depend upon the difficulty of the problem, the attitude and ability of the subject. The correlation of the rapidity of this emergence of insight with intelligence remains as a problem for further experimentation. Just what relation this insight may have to the possession of the ability to discover and invent is a most alluring field. Our experimentation is fruitful of a host of problems awaiting solution and provides the technique of attack upon many of them.

It remains to discover whether a subject's insight can be trained, whether some intelligent subjects lack it in large measure, whether it is closely related to inventive ability, just what is its relation to various sense organs, whether the amount of transfer can be largely increased over a period of time, just what effect the removal of the goals (signal lights) from certain presentations would have, just what

part the resolution of tension may be discovered to have, what the relation of insight may be to the so-called process of 'conditioning', and many other facts.

In our experiment relative judgments have been carried further than heretofore into the field of relationships between relationships which is a new field of experimentation. We have developed a new technique. The plotting of a triple curve graph to be combined with introspections or the observations of the experimenter step by step throughout the experiment is new. The use of the performance curve showing the point of insight is new. We find, in general the same principles operating which have been discovered to hold in the simpler relational judgments. Köhler's statement (25) that "A total field would be experienced without insight, if all its several states, wholes, attitudes, etc., were simply given as a pattern, in which none was felt directly to depend upon any other and none to determine any other.", seems to be the zero point from which we proceed to full insight in our experiment. Helson's summary (26) taken from Wertheimer (27) states that "Insight depends upon the ability to break up existing configurational structures and to make fruitful transpositions from one configuration to another" and seems to apply to the process of analysis of our subjects.

(25) Köhler, Wolfgang, "Gestalt Psychology." 1929, New York, Horace Liveright, p. 371-372.

(26) Helson, Harry, "The Psychology of Gestalt." Amer. Jour. Psychol., Vol. 37, p. 55.

(27) Wertheimer, M., Ueber Schlussprozesse im produktiven Denken, Berlin, 1920.

VII. CONCLUSIONS

This experiment would seem to justify the following results:

1. Insightful behavior can be represented by a performance curve showing an upward drift. This drift is due to the emergence of a "hunch" or unanalyzed experience which grows clearer and clearer in the form of a differentiation process. Finally full insight emerges like the emergence of figure out of ground.

2. The light intensities may be shifted within the limits of clearness and if the ratio remains the same, the experiment is unchanged, showing transposition and satisfying this criterion of insight.

3. This experiment shows transfer in the solution of problems of relationships.

4. There is a pause or period of deliberation just previous to full insight.

5. Neither too rapid nor too deliberate responses are conducive to the early emergence of full insight.

6. The technique of this experiment gives promise as an accurate approach to the measurement of the insight of the subject.

7. As this experiment can be made entirely non-verbal, it is adapted to the measurement of races, ages, and types of both human and animal organisms.

Finally, we see the possibility of constructing a test using relative judgments between pairs of light intensities which will prove most valuable, in the determination of the Intelligence Quotient, in measuring insight, and in giving data upon the emotional and attitudinal behavior of both normal and abnormal subjects.

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